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Sorkin

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(54) **ENCAPSULATED SPLICE CHUCK**

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E04C 5/08 (2006.01)
E04C 5/16 (2006.01)
E04C 5/12 (2006.01)
E04G 21/12 (2006.01)

(52) **U.S. Cl.**

CPC ***E04C 5/165*** (2013.01); ***E04C 5/08*** (2013.01); ***E04C 5/122*** (2013.01); *E04G 21/121* (2013.01)

(58) **Field of Classification Search**

CPC E04C 5/165; E04C 5/08
USPC 52/223.1
See application file for complete search history.

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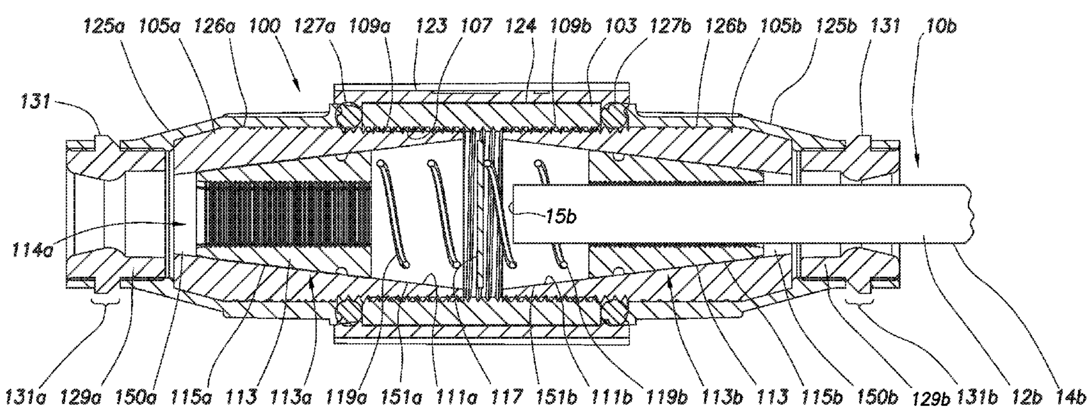
(57) **ABSTRACT**

An encapsulated splice chuck may include a splice chuck body and a body encapsulation positioned about an exterior surface of the splice chuck body. The encapsulated splice chuck may also include a first forcing cone threadedly coupled to the splice chuck body, the first forcing cone including a tapered inner surface. In addition, the encapsulated splice chuck may include a first forcing cone encapsulation positioned about an exterior surface of the first forcing cone and a first set of wedges positioned within the first forcing cone. The encapsulated splice chuck may include a second forcing cone mechanically coupled to the splice chuck body, the second forcing cone including a tapered inner surface, and a second forcing cone encapsulation positioned about an exterior surface of the second forcing cone. The encapsulated splice chuck may also include a second set of wedges positioned within the second forcing cone.

18 Claims, 5 Drawing Sheets



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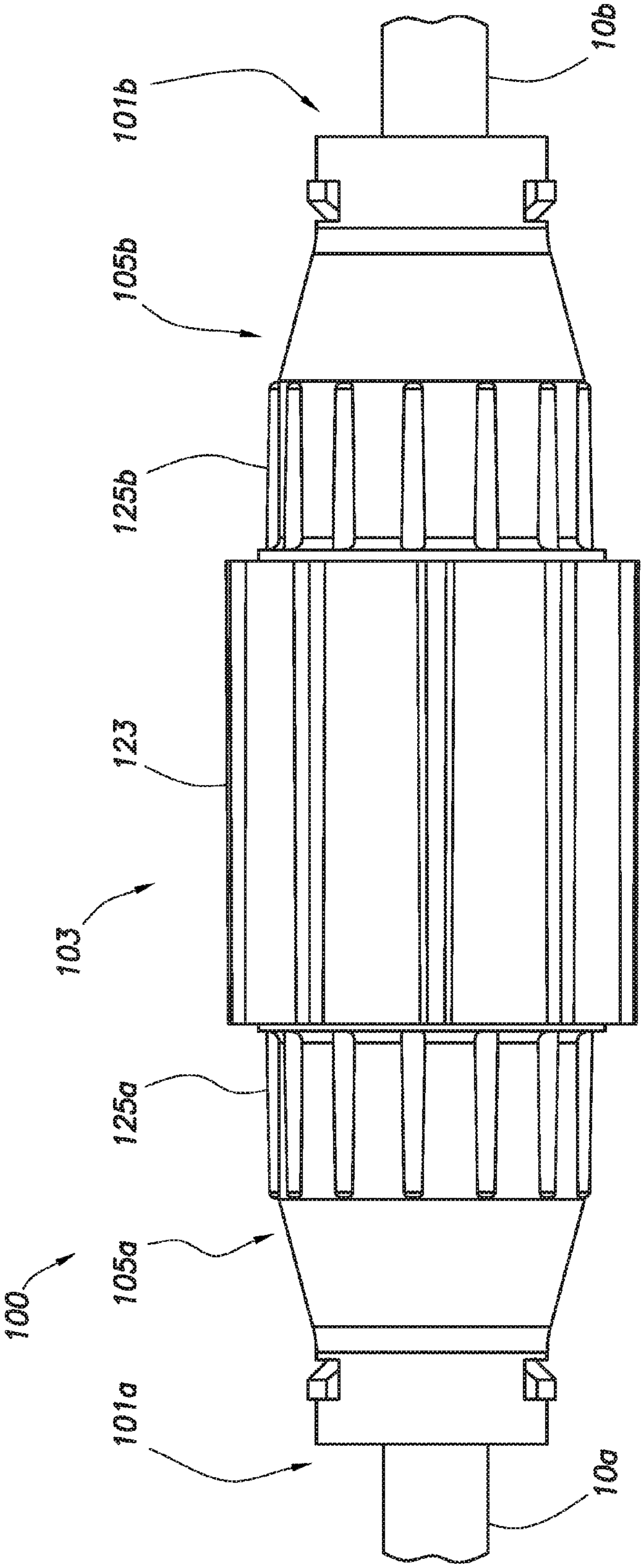
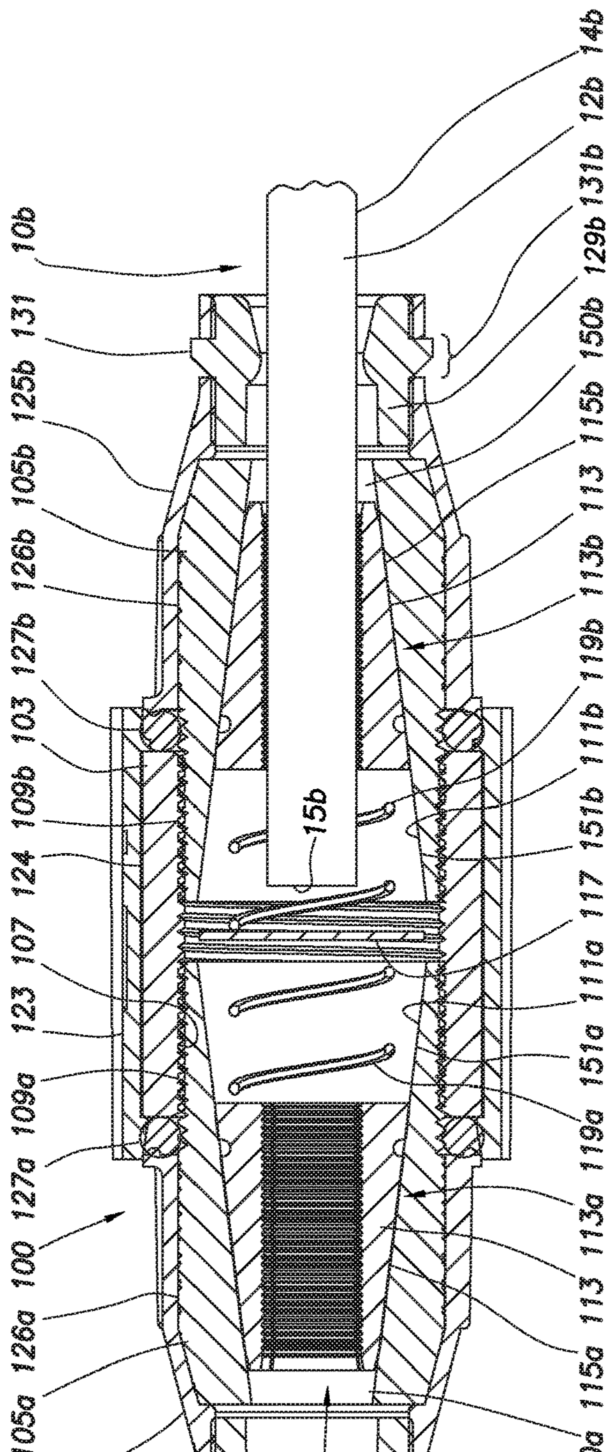


FIG. 1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105b
126b
127b
103
109b
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114a
14b
12b
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129b
150b
115b
113
113b
119b
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150a
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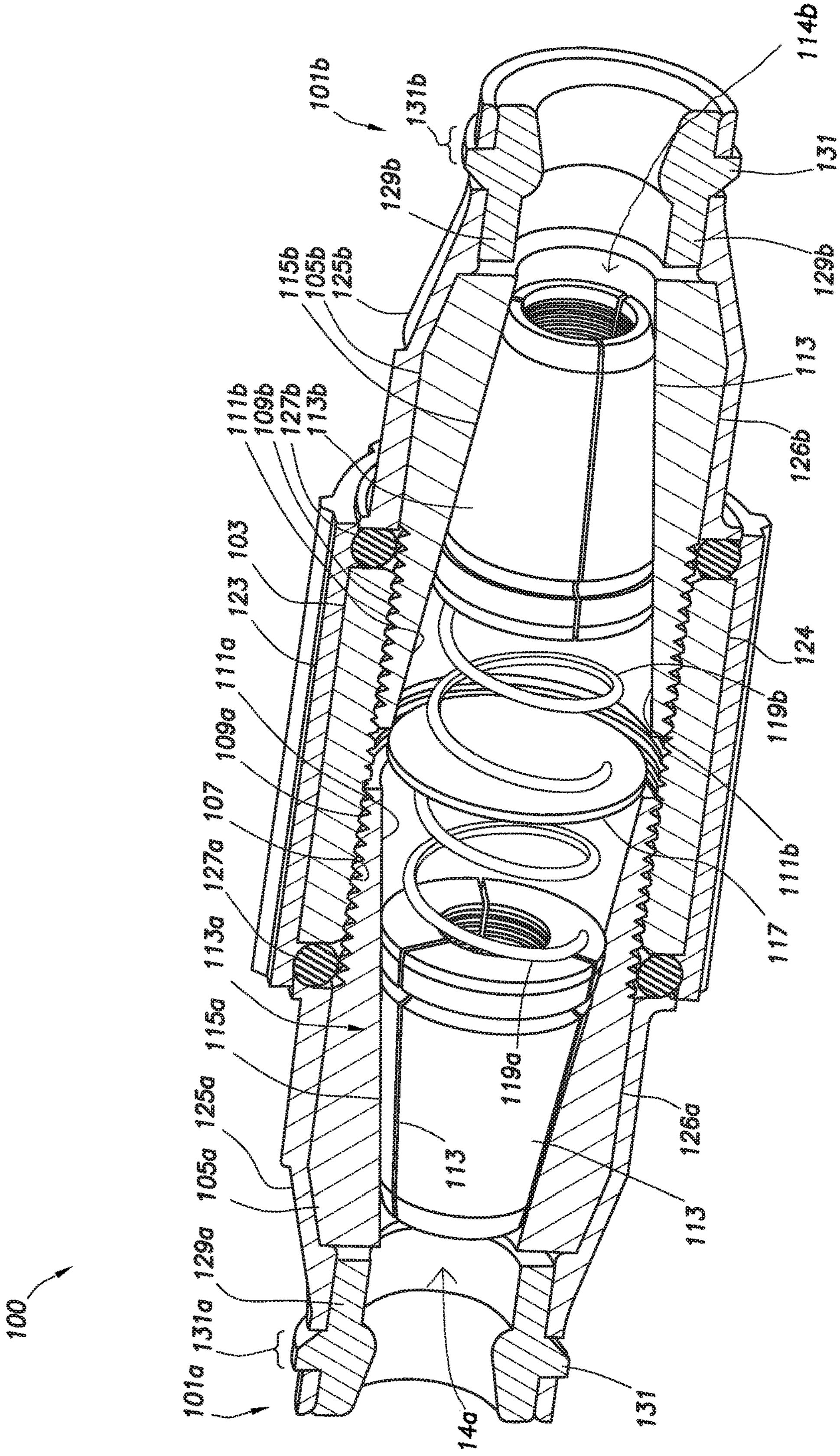
131a
15b

FIG. 2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101a
101b
103
105a
105b
107
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111a
111b
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114a
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115a
115b
117
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131
131a
131b

FIG.3

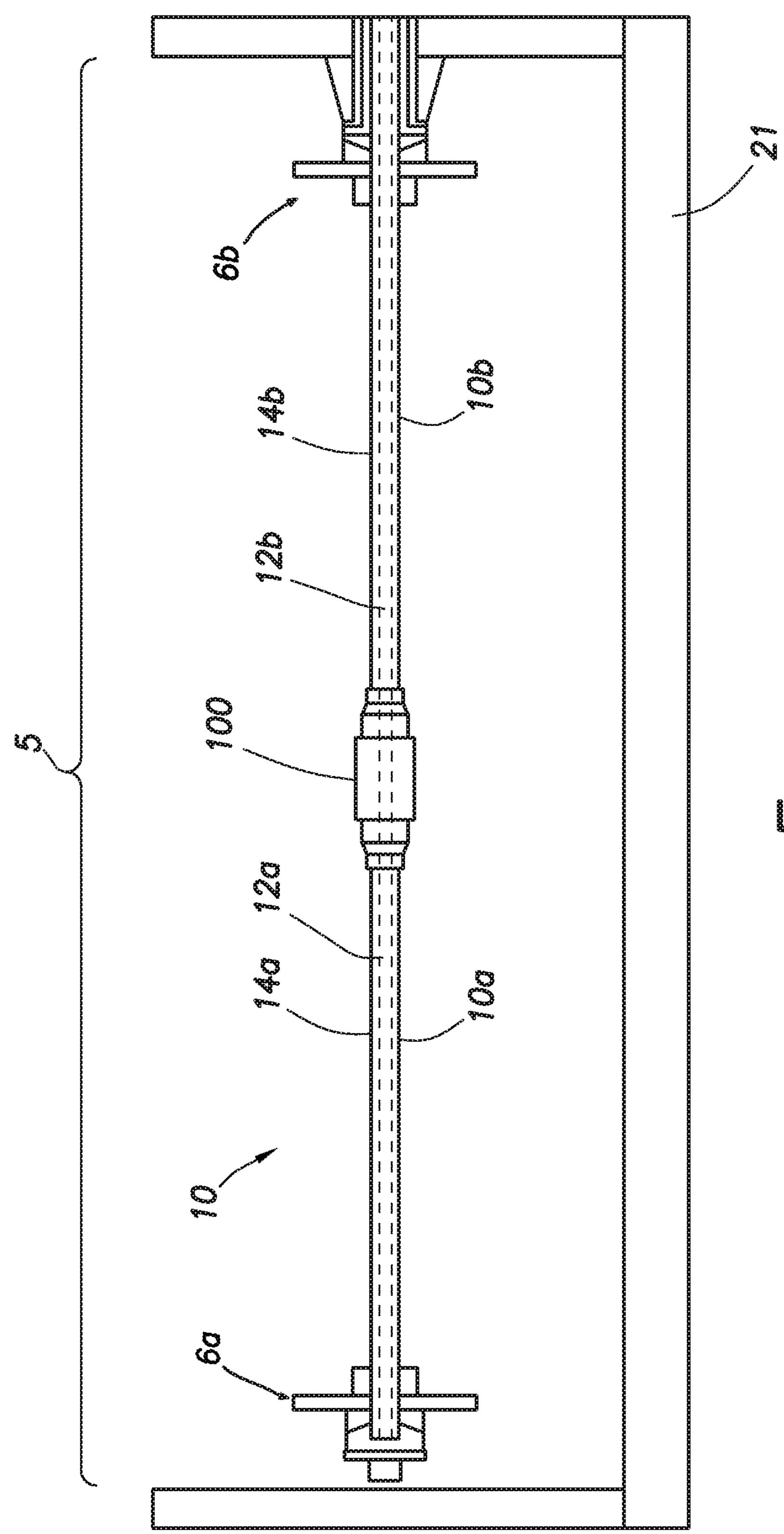

FIG. 4A

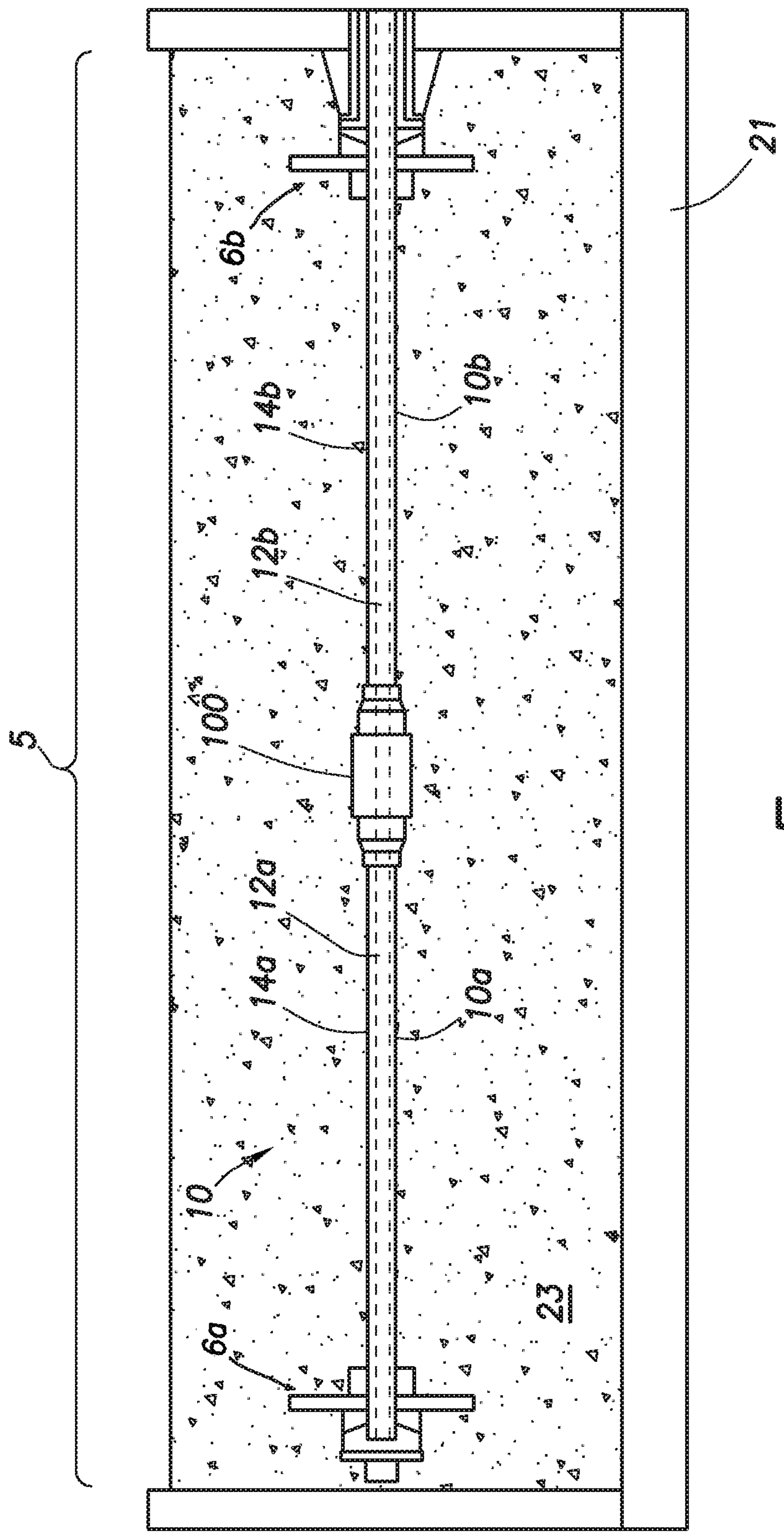

FIG.4B

ENCAPSULATED SPLICE CHUCK

CROSS-REFERENCE TO RELATED APPLICATIONS

This application is a nonprovisional application which claims priority from U.S. provisional application No. 62/362,285, filed Jul. 14, 2016.

TECHNICAL FIELD/FIELD OF THE DISCLOSURE

The present disclosure relates to post-tension anchorage systems.

BACKGROUND OF THE DISCLOSURE

Many structures are built using concrete, including, for instance, buildings, parking structures, apartments, condominiums, hotels, mixed-use structures, casinos, hospitals, medical buildings, government buildings, research/academic institutions, industrial buildings, malls, roads, bridges, pavement, tanks, reservoirs, silos, sports courts, and other structures.

Prestressed concrete is structural concrete in which internal stresses are introduced to reduce potential tensile stresses in the concrete resulting from applied loads; prestressing may be accomplished by post-tensioned prestressing or pre-tensioned prestressing. In post-tensioned prestressing, a tension member is tensioned after the concrete has attained a specified strength by use of a post-tensioning tendon. Traditionally, a tension member is constructed of a suitable material exhibiting tensile strength which can be elongated including, for example, reinforcing steel, single or multi-strand cable. Typically, the tension member may be formed from a metal or composite material.

SUMMARY

Certain embodiments of the present disclosure are directed to an encapsulated splice chuck. The encapsulated splice chuck includes a splice chuck body and a body encapsulation positioned about an exterior surface of the splice chuck body. The encapsulated splice chuck also includes a first forcing cone threadedly coupled to the splice chuck body, the first forcing cone including a tapered inner surface. In addition, the encapsulated splice chuck includes a first forcing cone encapsulation positioned about an exterior surface of the first forcing cone and a first set of wedges positioned within the first forcing cone. The encapsulated splice chuck includes a second forcing cone mechanically coupled to the splice chuck body, the second forcing cone including a tapered inner surface, and a second forcing cone encapsulation positioned about an exterior surface of the second forcing cone. The encapsulated splice chuck also includes a second set of wedges positioned within the second forcing cone.

Other embodiments of the present disclosure are directed to a method. The method includes providing an encapsulated splice chuck. The encapsulated splice chuck includes a splice chuck body and a body encapsulation positioned about an exterior surface of the splice chuck body. The encapsulated splice chuck also includes a first forcing cone threadedly coupled to the splice chuck body, the first forcing cone including a tapered inner surface. In addition, the encapsulated splice chuck includes a first forcing cone encapsulation positioned about an exterior surface of the first forcing cone and a first set of wedges positioned within the first forcing cone. The encapsulated splice chuck includes a second forcing cone mechanically coupled to the splice chuck body, the second forcing cone including a tapered inner surface, and a second forcing cone encapsulation positioned about an exterior surface of the second forcing cone. The encapsulated splice chuck also includes a second set of wedges positioned within the second forcing cone. The method also includes providing a first and second tension member, each tension member including a strand and inserting the strand of the first tension member into the first set of wedges within the first forcing cone. The method additionally includes inserting the strand of the second tension member into the second set of wedges within the second forcing cone and applying tension to the first and second tension members to pull the first and second sets of wedges into the first and second forcing cones and retard the first and second tension members from being removed from the encapsulated splice chuck.

Yet other embodiments of the present disclosure are directed to a system. The system includes a concrete form and a post-tensioning tendon. The post-tensioning tendon includes a first anchor, a second anchor, a first tension member, a second tension member, and an encapsulated splice chuck mechanically coupled to the first and second tension members. The encapsulated splice chuck includes a splice chuck body and a body encapsulation positioned about an exterior surface of the splice chuck body. The encapsulated splice chuck also includes a first forcing cone threadedly coupled to the splice chuck body, the first forcing cone including a tapered inner surface. In addition, the encapsulated splice chuck includes a first forcing cone encapsulation positioned about an exterior surface of the first forcing cone and a first set of wedges positioned within the first forcing cone. The encapsulated splice chuck includes a second forcing cone mechanically coupled to the splice chuck body, the second forcing cone including a tapered inner surface, and a second forcing cone encapsulation positioned about an exterior surface of the second forcing cone. The encapsulated splice chuck also includes a second set of wedges positioned within the second forcing cone.

BRIEF DESCRIPTION OF THE DRAWINGS

The present disclosure is best understood from the following detailed description when read with the accompanying figures. It is emphasized that, in accordance with the standard practice in the industry, various features are not drawn to scale. In fact, the dimensions of the various features may be arbitrarily increased or reduced for clarity of discussion.

FIG. **1** depicts a side view of an encapsulated splice chuck consistent with at least one embodiment of the present disclosure.

FIG. **2** depicts a cross section view of an encapsulated splice chuck consistent with at least one embodiment of the present disclosure.

FIG. **3** depicts a perspective cutaway view of an encapsulated splice chuck consistent with at least one embodiment of the present disclosure.

FIGS. **4**A-**4**B depict an encapsulated splice chuck consistent with at least one embodiment of the present disclosure within an anchor assembly in a concrete segment.

DETAILED DESCRIPTION

It is to be understood that the following disclosure provides many different embodiments, or examples, for implementing different features of various embodiments. Specific examples of components and arrangements are described below to simplify the present disclosure. These are, of course, merely examples and are not intended to be limiting. In addition, the present disclosure may repeat reference numerals and/or letters in the various examples. This repetition is for the purpose of simplicity and clarity and does not in itself dictate a relationship between the various embodiments and/or configurations discussed.

FIG. **1** depicts a side view of encapsulated splice chuck **100** consistent with at least one embodiment of the present disclosure. In some embodiments, first tension member **10***a* may join to first end **101***a* of encapsulated splice chuck **100** and second tension member **10***b* may join to second end **101***b* of encapsulated splice chuck **100**. In some embodiments, encapsulated splice chuck **100** may mechanically couple first tension member **10***a* to second tension member **10***b*.

In some embodiments, as depicted in FIGS. **2**, **3**, encapsulated splice chuck **100** may include splice chuck body **103**, first forcing cone **105***a*, and second forcing cone **105***b*. In certain non-limiting embodiments, splice chuck body **103** may be tubular or annular. In some embodiments, splice chuck body **103** may include internal thread **107** and each forcing cone **105***a*, **105***b* may include external thread **109***a*, **109***b*. The combination of internal thread **107** and external thread **109***a*, **109***b* may be adapted to allow each forcing cone **105***a*, **105***b* to threadedly couple to splice chuck body **103**.

In some embodiments, forcing cones **105***a*, **105***b* may include tapered inner surfaces **111***a*, **111***b* respectively. Tapered inner surfaces **111***a*, **111***b* may taper such that the inner diameter of forcing cone **105***a* is smaller at outside end **150***a* of forcing cone **105***a* than inside end **151***a* of forcing cone **105***a* and that the inner diameter of forcing cone **105***b* is smaller at outside end **150***b* of forcing cone **105***b* than inside end **151***b* of forcing cone **105***b*.

In some embodiments, encapsulated splice chuck **100** may also include wedges **113**. Wedges **113** may be included in first set of wedges **113***a* and second set of wedges **113***b*. First and second sets of wedges **113***a*, **113***b* may be positioned within first and second forcing cones **105***a*, **105***b*, respectively. First and second sets of wedges **113***a*, **113***b* may include tapered outer surfaces **115***a*, **115***b*, which may match tapered inner surfaces **111***a*, **111***b* of forcing cones **105***a*, **105***b*. In some embodiments, each of first set of wedges **113***a* and second set of wedges **113***b* may include two or more wedges **113** positioned radially about the interior of forcing cones **105***a*, **105***b*. In some embodiments, each of first set of wedges **113***a* and second set of wedges **113***b* may define a generally cylindrical interior surface **114***a*, **114***b*, respectively.

In some embodiments, encapsulated splice chuck **100** may include central disk **117**. Central disk **117** may be positioned within splice chuck body **103**, and may separate first end **101***a* and second end **101***b* of encapsulated splice chuck **100**. In some embodiments, encapsulated splice chuck **100** may include springs **119***a*, **119***b*. Spring **119***a* may extend between first set of wedges **113***a* and central disk **117**, and spring **119***b* may extend between second set of wedges **113***b* and central disk **117**. Springs **119***a*, **119***b* may bias first and second sets of wedges **113***a*, **113***b* into the respective forcing cone **105***a*, **105***b*. Springs **119***a*, **119***b* may be formed of metal, such as steel, or a polymer. In certain embodiments, springs **119***a*, **119***b* may be omitted.

In some embodiments, encapsulated splice chuck **100** may include body encapsulation **123**. Body encapsulation **123** may be positioned about exterior surface **124** of splice chuck body **103**. In some embodiments, each forcing cone **105***a*, **105***b* may be encapsulated by forcing cone encapsulation **125***a*, **125***b*. Forcing cone encapsulation **125***a*, **125***b* may be positioned about exterior surfaces **126***a*, **126***b* of the respective forcing cone **105***a*, **105***b*. In some embodiments, body encapsulation **123** may be molded to splice chuck body **103**, and forcing cone encapsulation **125***a*, **125***b* may be molded to forcing cones **105***a*, **105***b*. In some embodiments, body encapsulation **123** and forcing cone encapsulation **125***a*, **125***b* may be formed from a polymer such as epoxy, phenolic resin, nylon, polyethylene (including, but not limited to, high density polyethylene (HDPE)), polystyrene, or combinations thereof, or any other suitable material.

In some embodiments, as each forcing cone **105***a*, **105***b* is threadedly coupled to splice chuck body **103**, the respective forcing cone encapsulation **125***a*, **125***b* may at least partially engage body encapsulation **123**. In some embodiments, encapsulated splice chuck **100** may include one or more seals **127***a*, **127***b* positioned between forcing cones **105***a*, **105***b* and splice chuck body **103**. For example, first seal **127***a* may be positioned between forcing cone **105***a* and splice chuck body **103**, and second seal **127***b* may be positioned between forcing cone **105***b* and splice chuck body **103**. In some embodiments, seals **127***a*, **127***b* may include O-rings or any other suitable seal. In some embodiments, seals **127***a*, **127***b* may retard fluid ingress between body encapsulation **123** and forcing cone encapsulation **125***a*, **125***b*. In some embodiments, body encapsulation **123** and forcing cone encapsulation **125***a*, **125***b* may protect one or more of splice chuck body **103**; forcing cones **105***a*, **105***b*; first and second sets of wedges **113***a*, **113***b*; central disk **117**; springs **119***a*, **119***b*; and any portion of first and second tension members **10***a*, **10***b* within encapsulated splice chuck **100** from exposure to the surrounding environment, including, for example and without limitation, protection from moisture or other corrosive sources. In certain embodiments, seals **127***a*, **127***b* may be formed from a natural or synthetic rubber, including, but not limited to EPDM rubber.

In some embodiments, encapsulated splice chuck **100** may include sheathing seals **129***a*, **129***b*. Sheathing seals **129***a*, **129***b* may be positioned at first and second ends **101***a*, **101***b* respectively of encapsulated splice chuck **100**. Sheathing seals **129***a*, **129***b* may be annular in shape. In some embodiments, sheathing seals **129***a*, **129***b* may mechanically couple to respective forcing cone encapsulation **125***a*, **125***b*. In some embodiments, for example and without limitation, each sheathing seal **129***a*, **129***b* may include one or more tabs **131** which may fit into matching slots **131***a*, **131***b* formed in forcing cone encapsulation **125***a*, **125***b*. Sheathing seals may be any satisfactory material, including, but not limited to a polymer.

In some embodiments, as depicted in FIG. **1**, first and second tension members **10***a*, **10***b* may be mechanically coupled to encapsulated splice chuck **100**. Each tension member **10***a*, **10***b* may be inserted into a respective end **101***a*, **101***b* of encapsulated splice chuck **100**. As depicted in FIG. **2** with respect to second end **101***b* of encapsulated splice chuck **100**, second tension member **10***b* may include strand **12***b*. Strand **12***b* may be inserted into second end **101***b* of encapsulated splice chuck **100**. Strand **12***b* may press against second set of wedges **113***b* and fit through the generally cylindrical interior **114***b* thereof. In some embodiments, movement of second set of wedges **113***b* towards central disk **117** may be retarded by compression of spring **119***b*. In some embodiments, by placing tension on second tension member **10***b*, second set of wedges **113***b* may engage strand **12***b* and be pulled further into second forcing cone **105***b*. Tapered inner surface **111***b* of second forcing cone **105***b* may press second set of wedges **113***b* into strand **12***b* as second set of wedges **113***b* move into second forcing cone **105***b*. Strand **12***b* may thereby be prevented or retarded from being removed from encapsulated splice chuck **100** and second tension member **10***b* may thereby be mechanically coupled to encapsulated splice chuck **100**.

In some embodiments, second tension member **10***b* may include sheathing **14***b*. Sheathing **14***b* may have an outer diameter substantially the same as or larger than an inner diameter of sheathing seal **129***b*. Sheathing **14***b* may, for example and without limitation, be close or press-fit into sheathing seal **129***b*. The close or press-fit between sheathing **14***b* and sheathing seal **129***b* may retard ingress of fluid into encapsulated splice chuck **100** through sheathing seal **129***b*. In some embodiments, a portion of sheathing **14***b* near the end **15***b* of second tension member **10***b* may be removed from second tension member **10***b* to allow a portion of strand **12***b* without sheathing **14***b* to enter second set of wedges **113***b*.

In some embodiments, first tension member **10***a* may be installed to first end **101***a* of encapsulated splice chuck **100** in substantially the same manner as second tension member **10***b* is installed to second end **101***b* of encapsulated splice chuck **100**.

As shown in FIGS. **4**A, **4**B post-tensioning tendon **5** may include for example and without limitation, anchor assemblies **6***a*, **6***b* and tension member **10**. In some embodiments, tension member **10** may include two or more tension member segments joined end to end, depicted as first and second tension members **10***a*, **10***b*. For example, tension member **10** may be severed during installation or two shorter lengths of tension member may be joined to form tension member **10**. Each tension member **10***a*, **10***b* may include strands **12***a*, **12***b* and sheathings **14***a*, **14***b* as previously described. In some embodiments, a duct (not shown) may be positioned about tension member **10**. Post-tensioning tendon **5** may be positioned within concrete form **21** such that it will be completely encased in concrete **23** as depicted in FIG. **4**B. Tension members **10***a*, **10***b* may be joined by encapsulated splice chuck **100** as previously discussed.

The foregoing outlines features of several embodiments. Such features may be replaced by any one of numerous equivalent alternatives, only some of which are disclosed herein. Equivalent constructions do not depart from the scope of the present disclosure and may include various changes, substitutions, and alterations herein without departing from the scope of the present disclosure.

The invention claimed is:

1. An encapsulated splice chuck comprising:
- a splice chuck body,
- a body encapsulation positioned about an exterior surface of the splice chuck body;
- a first forcing cone threadedly coupled to the splice chuck body, the first forcing cone including a tapered inner surface;
- a first forcing cone encapsulation positioned about an exterior surface of the first forcing cone;
- a first set of wedges positioned within the first forcing cone;
- a second forcing cone mechanically coupled to the splice chuck body, the second forcing cone including a tapered inner surface;
- a second forcing cone encapsulation positioned about an exterior surface of the second forcing cone; and
- a second set of wedges positioned within the second forcing cone;
- wherein the first and second cone encapsulations are each separate from the body encapsulation so that as each forcing cone is coupled to the splice chuck body, the respective forcing cone encapsulation at least partially engages the body encapsulation.

2. The encapsulated splice chuck of claim **1**, further comprising:
- a central disk positioned within the splice chuck body;
- a first spring extending between the first set of wedges and the central disk; and
- a second spring extending between the second set of wedges and the central disk.

3. The encapsulated splice chuck of claim **1**, further comprising:
- a first seal positioned between the first forcing cone and the splice chuck body so as to retard fluid ingress between the body encapsulation and the first forcing cone encapsulation; and
- a second seal positioned between the second forcing cone and the splice chuck body so as to retard fluid ingress between the body encapsulation and the second forcing cone encapsulation.

4. The encapsulated splice chuck of claim **1**, wherein the splice chuck body comprises an internal thread, and the first and second forcing cones each include an external thread, and wherein the first and second forcing cones are threadedly coupled to the splice chuck body.

5. The encapsulated splice chuck of claim **1**, wherein the first set of wedges comprises two or more wedges, and wherein the second set of wedges comprises two or more wedges.

6. The encapsulated splice chuck of claim **1**, further comprising a sheathing seal mechanically coupled to the first forcing cone.

7. The encapsulated splice chuck of claim **6**, wherein the sheathing seal further comprises a tab and the first forcing cone further comprises a matching slot formed in the first forcing cone encapsulation, the tab fitting into the matching slot.

8. The encapsulated splice chuck of claim **1**, wherein the body encapsulation, first forcing cone encapsulation, and second forcing cone encapsulation are formed from one or more of epoxy, phenolic resin, nylon, polyethylene, and polystyrene.

9. The encapsulated splice chuck of claim **1**, wherein the body encapsulation is molded to the exterior surface of the splice chuck body.

10. The encapsulated splice chuck of claim **1**, wherein the first forcing cone encapsulation is molded to the exterior surface of the first forcing cone, and the second forcing cone encapsulation is molded to the exterior surface of the second forcing cone.

11. The encapsulated splice chuck of claim **1**, wherein the body encapsulation, the first forcing cone encapsulation, and the second forcing cone encapsulation protect one or more of the splice chuck body, forcing cones, and sets of wedges from exposure to a surrounding environment.

12. The encapsulated splice chuck of claim **1**, wherein each forcing cone has an outside end and an inside end and wherein the inner diameter of each forcing cone is smaller at the outside end than at the inside end of that forcing cone.

13. A method comprising:
- providing an encapsulated splice chuck, the encapsulated splice chuck comprising:
  - a splice chuck body,

a body encapsulation positioned about an exterior surface of the splice chuck body;

a first forcing cone threadedly coupled to the splice chuck body, the first forcing cone including a tapered inner surface;

a first forcing cone encapsulation positioned about an exterior surface of the first forcing cone;

a first set of wedges positioned within the first forcing cone;

a second forcing cone mechanically coupled to the splice chuck body, the second forcing cone including a tapered inner surface;

a second forcing cone encapsulation positioned about an exterior surface of the second forcing cone; and

a second set of wedges positioned within the second forcing cone;

wherein the first and second cone encapsulations are each separate from the body encapsulation so that as each forcing cone is coupled to the splice chuck body, the respective forcing cone encapsulation at least partially engages the body encapsulation;

providing a first and second tension member, each tension member including a strand;

inserting the strand of the first tension member into the first set of wedges within the first forcing cone;

inserting the strand of the second tension member into the second set of wedges within the second forcing cone; and

applying tension to the first and second tension members to pull the first and second sets of wedges into the first and second forcing cones and retard the first and second tension members from being removed from the encapsulated splice chuck.

14. A system comprising:

a concrete form; and

a post-tensioning tendon, the post-tensioning tendon including:

a first anchor;

a second anchor;

a first tension member;

a second tension member; and

an encapsulated splice chuck mechanically coupled to the first and second tension members, the encapsulated splice chuck including:

a splice chuck body,

a body encapsulation positioned about an exterior surface of the splice chuck body;

a first forcing cone threadedly coupled to the splice chuck body, the first forcing cone including a tapered inner surface;

a first forcing cone encapsulation positioned about an exterior surface of the first forcing cone;

a first set of wedges positioned within the first forcing cone;

a second forcing cone mechanically coupled to the splice chuck body, the second forcing cone including a tapered inner surface;

a second forcing cone encapsulation positioned about an exterior surface of the second forcing cone; and

a second set of wedges positioned within the second forcing cone,

wherein the first and second cone encapsulations are each separate from the body encapsulation so that as each forcing cone is coupled to the splice chuck body, the respective forcing cone encapsulation at least partially engages the body encapsulation.

15. The system of claim **14**, further comprising:

a central disk positioned within the splice chuck body;

a first spring extending between the first set of wedges and the central disk; and

a second spring extending between the second set of wedges and the central disk.

16. The system of claim **14**, further comprising:

a first seal positioned between the first forcing cone and the splice chuck body so as to retard fluid ingress between the body encapsulation and the first forcing cone encapsulation; and

a second seal positioned between the second forcing cone and the splice chuck body so as to retard fluid ingress between the body encapsulation and the second forcing cone encapsulation.

17. The system of claim **14**, wherein the splice chuck body comprises an internal thread, and the first and second forcing cones each include an external thread, and wherein the first and second forcing cones are threadedly coupled to the splice chuck body.

18. The system of claim **14**, wherein the first set of wedges comprises two or more wedges, and wherein the second set of wedges comprises two or more wedges.

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